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STAPELIEAE (ASCLEPIADACEAE) FROM SOUTH TROPICAL AFRICA: VI

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ABSTRACT

Caralluma lutea N.E. Br. and its relationship with such species as *C. lateritia* N.E. Br., *C. nebrownii* Berger, *C. vaga* (N.E. Br.) White & Sloane and *C. knobelii* (Phillips) Phillips, is discussed in detail.

One new combination, *C. albocastanea* (Marl.) Leach, is made and several names reduced to synonymy under *C. knobelii* and *C. lutea*, of which latter two subspecies are recognised.

Closely related species such as *C. melanantha* (Schlecht.) N.E. Br. and *C. valida* N.E. Br. are also considered.

A key to the taxa dealt with is provided, together with a map showing their known distributions.

UITTREKSEL

Caralluma lutea N.E. Br. en die verwantskap met soorte soos *C. lateritia* N.E. Br., *C. nebrownii* Berger, *C. vaga* (N.E. Br.) White & Sloane en *C. knobelii* (Phillips) Phillips word breedvoerig bespreek.

Een nuwe kombinasie, *C. albocastanea* (Marl.) Leach word gemaak en verskeie name verlaag tot sinonieme onder *C. knobelii* en *C. lutea* met erkenning van twee subspesies vir laasgenoemde.

Naverwante soorte soos *C. melanantha* (Schlecht.) N.E. Br. en *C. valida* N.E. Br. word ook oorweeg.

'n Sleutel tot die taxa word voorsien, vergesel van 'n kaart waarop die verspreiding aangegee word.

The classification of the group of Carallumas from South Tropical Africa, in the *Caralluma lutea* N.E. Br. relationship, including *C. nebrownii* Berger, *C. vaga* (N.E. Br.) White & Sloane, *C. melanantha* (Schlecht.) N.E. Br. etc., presents some rather difficult problems.

The taxa involved are all apparently quite closely related, yet such is the extent of their variability that individual specimens of one species, considered in isolation have, in the past, been placed not only in different species but sometimes in different genera.

Throughout this paper a broad view of the species has been taken; not to have followed this policy would have resulted in the recognition of almost innumerable taxa, since it seems that within some species, not only are no two specimens identical but that the range of variation within even small populations may be almost unbelievably wide, e.g. *C. lutea* subsp. *lutea* in the vicinity of Bulawayo, Rhodesia.

Similar variability appears to occur almost throughout the genera comprising the tribe [cf. Leach & Plowes in Jl S. Afr. Bot. **33:** 99 (1967), when discussing

C. keithii R. A. Dyer], and has, no doubt, been largely responsible for the extent of the synonymy with which it is presently burdened.

Robert Brown's original distinction between the coronas of *Stapelia* and *Caralluma* (i.e. "*corona duplex*" and "*corona simplici serie* 10-*phylla*") appears to the writer, at least in the present context, to be sufficiently explicit; however, in N. E. Brown's note to his expanded diagnoses of the genera in Flora of Tropical Africa **4** (1902), the position seems to be made perfectly clear.

In view of Huber's proposed transfer of some members of the group to *Stapelia* (Asclepiadaceae, Prodr. Fl. S.W. Africa **114**, 1967) it is thought to be worth while to quote the relevant portions of N. E. Brown's note.

"The majority of species of *Caralluma* are easily recognised . . . by the outer corona being cupular or its lobes forming 5 small pouches, a few species, however . . . cannot be technically distinguished from *Stapelia*."

On this basis it seems that, however difficult may be the decision in respect of a "few species", there seems no doubt whatever that the taxa now under consideration belong in *Caralluma* as presently constituted.

It seems that there are two groups, falling under the present heading, which may be distinguished by the form of the inner lobes of their coronas, viz:
(1) The "lutea group" with the inner coronal lobes laterally compressed.
(2) The "valida group" in which these lobes are dorsi-ventrally compressed (i.e. strap-like) or stoutly subulate (sometimes + terete).

KEY TO THE ACCEPTED TAXA

Corolla lobes narrowly or very narrowly attenuate, narrowly ovate-attenuate or narrowly triangular, (2·8) 3 to 5 (7·4) times as long as wide.

Inner corona lobes distinctly 2-horned, the horns spreading-erect, falcate; the inner laterally much compressed, the outer similarly compressed or subconical . . . 1a. *C. lutea* subsp. *lutea*

Inner corona lobes simple, subulate obtuse, or sometimes dorsi-ventrally compressed (strap-like) then usually shortly bifid at the apex

Corolla less than 60 mm in diameter

Corolla lobes ciliate, relatively coarsely pubescent and usually to some extent bristly on the inner surface; outer corona lobes suberect, inner lobes strap-like, erect, recurved, usually shortly bifid at the apex . . . 5. *C. valida*

Corolla lobes not ciliate; corolla not bristly; outer corona lobes spreading, inner lobes simple, subulate, incumbent on the anthers, recurved at the connivent apices . . . . 6. *C. tsumebensis*

Corolla more than 60 mm in diameter; pubescence microscopic; inner corona lobes subulate, incumbent on the anthers, connivent, recurved at the apex

Corolla lobes ciliate . . . . 7. *C. huillensis*

Corolla lobes not ciliate . . . . 8. *C. gossweileri*

Corolla lobes ovate to broadly ovate or triangular to broadly triangular, acute or shortly acuminate

Corolla lobes 1·4 to 3 (usually ±1·8, very rarely 4·3) times as long as broad

Inner corona lobes somewhat excavated or subfurcate at the much broadened gibbous base, often echinulate or irregularly minutely gibbous . . . 4. *C. melanantha*

Inner corona lobes laterally compressed, distinctly 2-horned (very rarely with the outer horn much reduced), neither excavated nor subfurcate at the base, never echinulate

Corolla lobes usually more than 1·7 cm long (very exceptionally 1·2); flowers mostly unicoloured, reddish to blackish purple or rarely yellow, sometimes variegated or yellow spotted or flecked; horns of the inner corona lobes suberect . . . . 1b. *C. lutea* subsp. *vaga*

Corolla lobes generally less than 1·5 cm long (very exceptionally 2·0); flowers whitish, spotted with red-brown to dark purple

Pedicels more than 3·5 cm long; outer horn of inner corona lobes suberectly spreading, subequalling the inner horn; outer corona lobes ±2 mm long × 1·5 mm . . . . 2. *C. albocastanea*

Pedicels less than 3·5 cm long; outer horn of inner corona lobes widely (often subhorizontally) spreading, about half the length (or less) of the inner horn; outer corona lobes ±3 mm long × 2 mm 3. *C. knobelii*

Corolla lobes ± as broad as long (sometimes slightly broader) 0·7 cm to 1·6 cm long

Inner corona lobes somewhat excavated or subfurcate at the much broadened gibbous base, often echinulate or irregularly slightly gibbous 4. *C. melanantha*

Inner corona lobes laterally compressed, neither excavated nor subfurcate at the base, never echinulate . . . . 3. *C. knobelii*

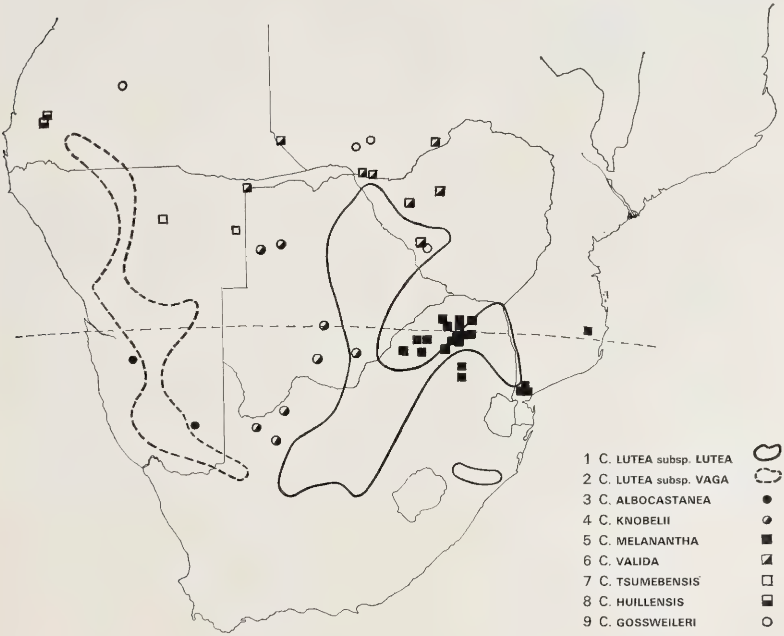


FIG. 1.

Due to the extent of the variability of most of the available characters (those discernible in dried material) it has been found virtually impossible to devise an infallible key. It is advisable therefore to confirm identifications from the locality; in the present instance this is a reasonably accurate procedure since such overlaps as may occur in the key are usually widely separated either spatially or ecologically or both.

Although the groups may be thus satisfactorily broadly divided and the taxa keyed out to subspecific level the taxonomic problems involved are by no means as simple of solution; particularly is this so in the "lutea group".

While the "valida group" appears perhaps to be the more variable, the problems involved seem to be rather more tractable (possibly only appearing so because of the relative paucity of material available). Despite the exasperating nature of this material, in which no two specimens are really alike, the taxa seem to be more readily separated into groups which are quite distinct, at least in those areas where their respective distributions impinge.

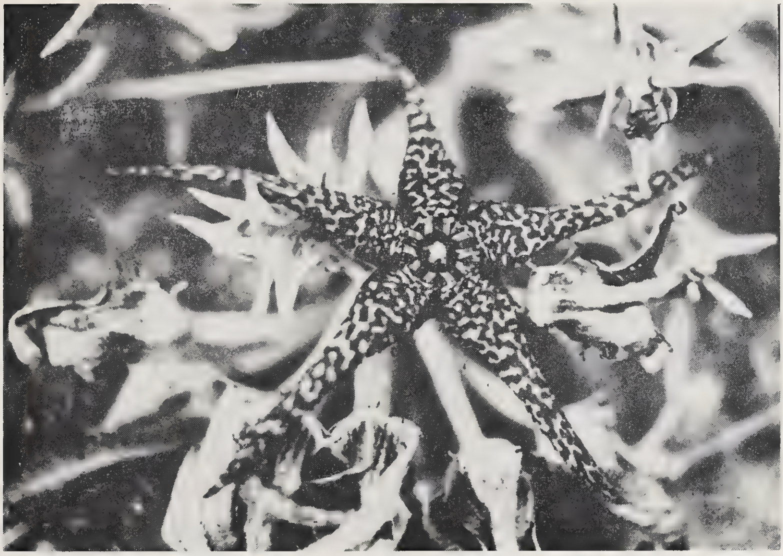
The situation in respect of this group has also been confused by the reputed pubescence of the stems of *C. huillensis*, an error which appeared to distinguish that species from all others in the group, when it is, in fact, very close indeed.

It seems probable that the "valida group" should be considered as representing two very variable species but it is considered that there is insufficient material available, in view of its variability, to provide logical bases for the delimitation of the subordinate taxa which, on present evidence, would appear then to require recognition. It is considered therefore, to be preferable to discuss the situation on the basis of the presently recognised species rather than to propose nomenclatural changes based on what is considered to be inadequate evidence.

Caralluma lutea N.E. Br. complex

Excluding *C. albocastanea* (Marl.) Leach and *C. knobelii* (Phillips) Phillips with its synonyms, which although apparently of common ancestry, are considered to be sufficiently differentiated to be recognised at specific level, as well as the quite distinct *C. melanantha* (Schlecht.) N.E. Br., we are left with a very variable complex which includes, at first sight, several apparently readily distinguishable taxa.

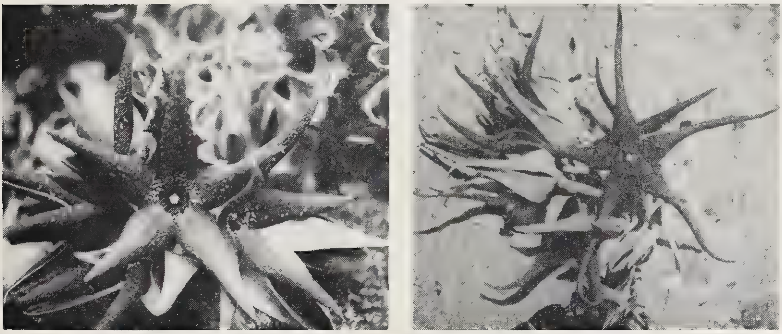
However, Phillips in Flower. Pl. S. Afr. **16:** t.621 (1936), correctly in my opinion, considered *C. vansonii* Bremek. & Oberm. to be merely a large-flowered form of *C. lutea*; while *C. lateritia* was reduced by Nel, in White & Sloane's monograph of 1937, to varietal status in the same species. Now that shaded bicoloured and variegated flowers, as well as unicoloured of various colours and shades are known, it seems that even this varietal distinction must fall away and *C. lutea* be recognised as being extremely variable as to both size and colour.



Mrs. W. Bullock 90g

Plant with heavily variegated flowers, dark maroon and yellow, from near Bulawayo, Rhodesia.

Photo by courtesy of Mr. E. J. Bullock



Plowes 1877

Plant with red-maroon flowers with yellow flecks and wide corolla lobes.

Photo L. C. Leach

Wild & Drummond 7224

Plant with flowers shaded from maroon to yellowish pink and very narrowly attenuate lobes, flowering between Rakops and Lake Dow, Botswana.

Photo by courtesy of Prof. H. Wild

FIG. 2. *Caralluma lutea* N.E. Br. subsp. *lutea*.

Typical *C. lutea* and *C. vaga* (N.E. Br.) White & Sloane, as represented by the S. African and Ovamboland populations respectively might well be considered to have reached a stage of development where differentiation would justify recognition as distinct species. However, the overall similarity, especially in coronal characters, when considered against the background of the apparently clinal nature of the variations exhibited by the intermediate populations, leads one inescapably to the conclusion that recognition at subspecific level is the only logical course, the two taxa seeming to be distinguished only by the respective proportions of their corolla lobes.

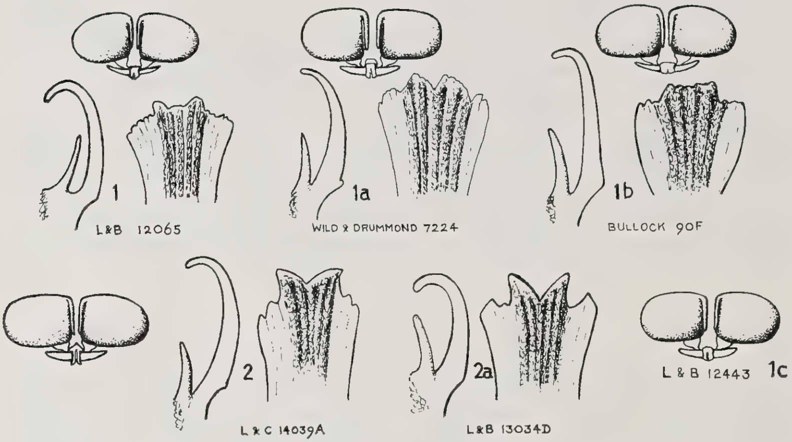


Fig. 3. *Caralluma lutea* N.E. Br.

Corona lobes × 5 approx. Pollinia × 15 approx.

Subsp. *lutea*.
1. Hammanskraal, Pretoria Distr., Transvaal ("lutea").
1a. Between Rakops and Lake Dow, Botswana ("vansonii").
1b. Near Bulawayo, Rhodesia ("lateritia").
1c. Near Mafeking, Northern Cape ("lutea").

Subsp. *vaga*.
2. Cahama, Huila Distr., S. Angola.
2a. Ondangua, Ovamboland, S.W. Africa.

There are two intermediate populations: one in S.W. Africa and the other in Rhodesia and Botswana, separated by the Kalahari where the closely related *C. knobelii* occurs. The Botswana and Rhodesia population is by far the more variable as to colour, but in shape and proportions of the corolla quite clearly belongs in subsp. *lutea*, typical examples of which overlap the intermediate population in some areas, so that no territorial division is possible.

The position regarding the S.W. African intermediate population, which includes *C. nebrownii* Berger and the variety *pseudonebrownii* (Dinter) White & Sloane, is not quite so clear-cut. Here plants may be found with corolla proportions closely coinciding with those of the Botswana and Rhodesian plants, while others merge gradually into typical subspecies *vaga*. The territorial separation of the two varieties of *C. nebrownii* as suggested by Dinter does not seem to be supported by the material presently available, so that it becomes quite impossible to separate these from each other or from typical subsp. *vaga*, with the distribution of which there is considerable overlap.

As it seems quite impracticable to give taxonomic recognition to these intermediate populations it is considered that the S.W. African plants are best accommodated in subsp. *vaga*, especially in view of their considerable spatial separation from those intermediate populations referrable to subsp. *lutea*. Accordingly *C. nebrownii* has been included in the synonymy of subsp. *vaga*. A very few specimens (mainly from among those with variegated flowers, i.e. var. *pseudonebrownii*) may, on the basis of corolla lobe proportions, key out to subsp. *lutea* but this serves, perhaps, to emphasise the conspecific nature of the taxa.

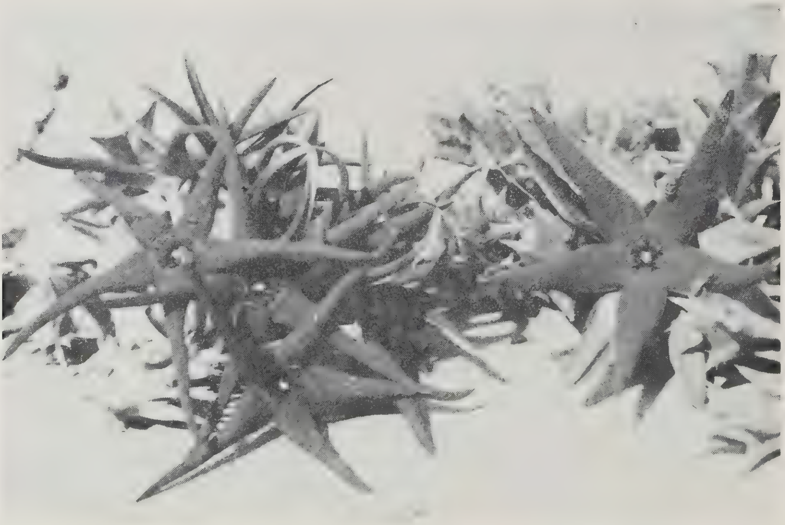
1a. Subsp. **lutea**

Caralluma lutea N.E. Br. in Hooker's Icon. Pl. **10:** t.1901 (1891); Hooker's Gdnrs' Chron. **12:** 370 (1892); Fl. Cap. **4**,1: 885 (1909) et in Curtis's bot. Mag. **135:** t.8265 (1909).——Berger, Stap. ü. Klein.: 84 (1910).——Schlechter in Engl., Bot. Jb. **20**,3: 54 (1895) et in Britten, J. Bot. Lond. **36:** 475 (1898).——K. Schum. in Engl. & Prantl, Pflanzenfam. **4**,2: 278 et fig. 83E & F (1897).——Wilman, Check List Griq. West: 173 (1906).——Phillips in Flower. Pl. S. Afr. **10:** t.379 (1930) et **16:** t.621 (1936).——Marloth, Fl. S. Afr. **3**,1: 97 et Pl. 23 (1932).——Bremek. & Oberm. in Ann. Transv. Mus. **16:** 428 (1935).——White & Sloane, Stap. **1:** 360 (1937).——Hutch., Botanist S. Afr.: 426 (1949).——Luckhoff, Stap. S. Afr.: 61 (1952).——Jacobsen, Handb. Succ. Pl. **1:** 249 et fig. 238 (1960).——Letty, Wild Flower. Transv.: 264 et fig. 130 (1962).

Syntypes: "From the Transvaal country" *Sanderson* s.n. (K!); *Mrs. Barber*; Klip Drift, *Tuck* in *MacOwan 2240* (K!); Diamond Fields, *Tuck* hort. *MacOwan 2240* (G-DC! K! PRE! SAM!); Griqualand West, *Bowker* in *Barkly 7* (K!); Du Toit's Pan, *Barkly 40* (K!).

Lectotype: Klip Drift, *Tuck* in *MacOwan 2240* (K!).

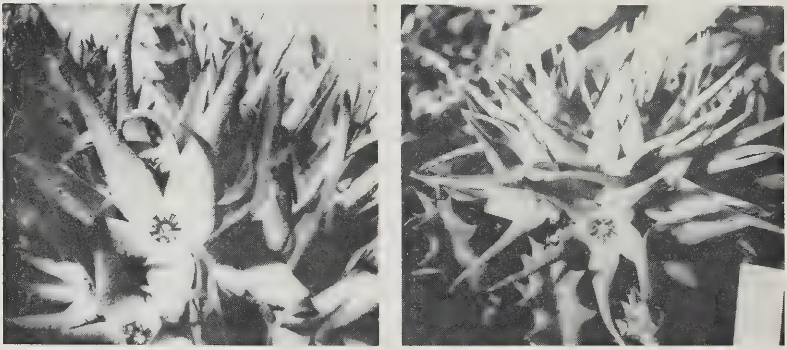
Tuck in *MacOwan 2240* has been selected as the lectotype as not only are there several specimens under this number in various herbaria, but also a pen sketch with some loose flowers on a sheet at Kew which appears possibly to have been the base of N. E. Brown's description.



Plowes 1705 *Plowes* 1943

Maroon flowered plants, one yellow spotted, from Lucydale Farm, Matopos, Rhodesia, shewing variation in corolla lobe width.

Photo by courtesy of Mr. D. C. H. Plowes



Leach 9770

Plant with yellow flowers and maroon striped corona from near Pietersburg, Transvaal.

Photo L. C. Leach

Plowes 1529

Plant with pale red flowers and maroon striped corona from Nyamandhlovu, Rhodesia.

Photo L. C. Leach

FIG. 4. *Caralluma lutea* N.E. Br. subsp. *lutea*.

It seems possible that all the specimens under this number were cultivated by MacOwan and that the most likely wild locality was Klip Drift (now Barkly West) as this was cited by Miss Wilman in her Check List (*l.c.*) as well as being the only precise locality mentioned on the sheets at Kew (the SAM specimen is indicated as being from Dutoitspan, but is the only *Tuck* specimen so located).

Caralluma lateritia N.E. Br. in Flora trop. Afr. **4**,1: 486 (1903).——Berger, op. cit.: 86 (1910).——Eyles, Trans. R. Soc. S. Afr. **5:** 451 (1916).——White & Sloane, tom. cit.: 370 (1937).——Luckhoff, op. cit.: 33, 64 (1952).——Jacobsen, tom. cit.: 248 (1960).

Type: Botswana, Ngamiland, Botletle Flats, *Lugard 307* (K!).

Caralluma vansonii Bremek. & Oberm. in Ann. Transv. Mus. **16:** 429 (1935).——White & Sloane, tom. cit.: 364 (1937).——Jacob., tom. cit.: 257 (1960).

Type: Botswana, Nkate, Nata River, *Van Son* (PRE!).

Caralluma lateritia var. *stevensonii* White & Sloane, tom. cit.: 371 (1937).——Jacob., tom. cit.: 248 (1960).

Type: Rhodesia, Wankie Distr., Matetsi, *Stevenson* (no material traced).

Caralluma lutea var. *lateritia* (N.E. Br.) Nel, in White & Sloane, tom. cit.: 373 (1937).——Jacob., tom. cit.: 249 (1960).

Type: As for *Caralluma lateritia* N.E. Br.

Caralluma lutea var. *vansonii* (Bremek. & Oberm.) Luckhoff, op. cit.: 62, 63 (1952).

Type: As for *Caralluma vansonii* Bremek. & Oberm.

Stapelia vaga sensu Huber in Prodr. Fl. S.W. Afr. **114:** 62 (1967), pro parte quoad syn. *Caralluma lateritia* N.E. Br. et *C. lutea* var. *lateritia* (N.E. Br.) Nel.

Subspecies *lutea* is characterised by its narrowly attenuate corolla lobes which are generally about 3 to 5 times as long as wide, the full range of this ratio varying, in the material seen, from 2·8 to 7·4 : 1, the extremes being, however, of uncommon occurrence.

Number and size of flowers and length of pedicels, whilst very variable, seem to be of no taxonomic significance, although the general trend appears to be for larger flowers and longer pedicels to occur more frequently towards the westerly and particularly the northerly limits of the distribution. The largest flowers and greatest colour variations (from the typical yellow to dark, sometimes almost black, red or maroon) occur in the northern Botswana and Rhodesian populations, in which, although unicoloured corollas predominate, shaded, speckled and variegated flowers are to be found, while plants with contrastingly coloured and often striped coronas are not uncommon. Colour variation in the southern areas of distribution appears to be limited to varying shades of yellow; collectors' notes recording "mustard", "brownish", "almost green", and rarely "orange", while striped coronas are also to be found.

In the following lists of material seen, specimens are located: for Angola under the Administrative Districts, for the Flora Zambesiaca area under the divisions of the area as set out in Flora Zambesiaca **1** (1960) and for S.W. Africa and S. Africa using the grid system of reference as recommended by the Botanical Research Institute, Pretoria.

Records of gatherings by Leach & Bayliss, Leach, Bayliss & Lamont, Leach & Noel and Leach & Cannell have been abbreviated to L. & B., L., B. & L., L. & N., and L. & C. respectively.

Cult. Greendale and cult. Nelspruit refers to plants grown in the author's gardens at Greendale, Salisbury, Rhodesia and Nelspruit, E. Transvaal, S. Africa.

BOTSWANA. **N:** Rakops, Botletle Flats, Ngamiland, *Lugard 307* (K). Nkate, Nata Riv., cult. Transv. Mus. No. 28760, fl. March 1931, *Van Son* s.n. (PRE; SRGH). Makarikari Pan, cult. NBG 52/57, fl. 13.iv.1959, *Nat. Mus. Rhod.* in Herb. Compton *28234* (NBG). Gweta, cult. SRGH, No. 4071, fl. Jan. 1967, *Smithers* s.n. (SRGH). Between Rakops and Lake Dow, cult. SRGH, fl. Nov./Dec. 1965, *Wild & Drummond 7224* (K; PRE; SRGH).

SE: ± 40 mls. N of Serowe, cult. SRGH fl. Jan. 1966, *Wild & Drummond 7280* (K; KIEL; LISC; PRE; SRGH). Serowe, cult. Nelspruit, *L. & B. 12515* (BR; M; NBG), *L. & B. 12516* (BM; BOL; G; K; LISC; LISU; MAH; PRE; SRGH; Z), 12516A (K; LISC; MO; PRE; SRGH); ibid. cult. SRGH, fl. 1969, *Liversedge* s.n. (K. LISC; PRE; SRGH; WIND). Letlhakeng, cult. Nelspruit, *L., B. & L. 12489* (B; BOL; FI; K; KMG; LISC; MAH; NBG; PRE; S; SRGH; ZSS). ± 11 mls. N of Gaberones, cult. Greendale, 15.i.1960, *L. & N. 101* (SRGH), ibid. *102* (SRGH). Metsimaklaba, near Gaberones, 9.iii.1930, *Van Son* in Herb. Transv. Mus. *28756* (PRE). Gaberones, 15.iii.1930, *Van Son* in Herb. Transv. Mus. *28755* (PRE). ± 4 mls. S of Gaberones, cult. Greendale, iii.1960, *L. & N. 94* (SRGH). ±10 mls. S of Gaberones, cult. Nelspruit, *L., B. & L. 12485* (COI; FHO; GRA; HEID; J; KIEL). Near Ramoutsa, cult. Nelspruit *L., B. & L. 12483* (BM; BOL; G; K; LUA; NBG; SRGH), *12484* (STE); Nuane Dam (NW of Lobatsi), cult. Nelspruit, *12460* (BOL; COI; FI; MO). ± 8 mls. N of Lobatsi, cult. Greendale, iii.1960, *L. & N. 212* (SRGH), ± 3 mls. N of Lobatsi, cult. Greendale, fl. Feb./March 1960, *L. & N. 122* (GRA; SRGH), *133* (SRGH), *136* (PRE; SRGH), ± 2 mls. N of Lobatsi, *120* (NH; PRE; SRGH). ± 3 mls. SE of Lobatsi, cult. Nelspruit *L., B. & L. 12472* (BR; LMA; M; NH; PUC; ZSS), *12472B* (LISC), *12472D* (G), *12472E* (K; PRE).

± 3 mls. S of Lobatsi, cult. Greendale, iii.1960, *L. & N. 157* (HEID; SRGH). ± 7 mls. W of Lobatsi, cult. Nelspruit, *L., B. & L. 12464* (B; BM; GRA). ± 10 mls. S of Lobatsi, cult. Nelspruit, *12453* (K; KIEL; KMG; LUAI; M). Baralong, cult. SRGH No. 3719, fl. ii.1968, *Smithers* s.n. (K; SRGH). ± 6 mls. N of Border Gate, cult. Nelspruit, *L. & B. 12447* (LISJC), ± 1 ml. N of Border Gate, *12445A* (J; STE). ± 28 mls. NW of Mafeking, ii.1958, *Acocks 18760* (PRE).

RHODESIA. **W:** Bulawayo, Feb. 1904, *Eyles 22* (SRGH); "Bulawayo Distr.", Jan. 1921, *Tapscott* s.n. (PRE); Plumtree, 20.x.1936, *Eyles 8763* (K), iii.1949, *Davies* s.n. (SRGH); ± 15 mls. NE of Bulawayo, cult. Greendale, ii.1960, *Leach 5818* (K; PRE; SRGH); ibid. *Biegel* s.n. (SRGH); Matopos, near Rhodes's Grave, cult. 21.xii.1906, *Ayres* in *Pillans 51* (BOL); Nyamandhlovu Research Sta., *Plowes 1529* (K; PRE; SRGH); Matopos Research Sta., Burford Farm, ii.1953, *Plowes 1705* (SRGH), x.1955, *Plowes 1877* (PRE), idem cult. Nyamandhlovu, xi.1952, *Plowes 1877* (SRGH), idem cult. Greendale, *Plowes* in *Leach 5555* (K; LISC); Manzimbomvu Riv., Matopos, cult. Umtali, 21.xi.1967, *Plowes 1896* (K; PRE; SRGH), cult. Greendale, in *Leach 5561* (BOL; SRGH); ibid. cult. Nelspruit, 8.xi.1965, *Bullock 53* (BM; LISC); Matopos Research Sta., Lucydale Farm, 30.i.1967, *Bullock 78* (SRGH); ibid. *Plowes 1943* (M); ibid. cult. Umtali, 8.xi.1968, *Plowes 3025* (SRGH); Sibizena Hill, near Matopos Mission, cult. Burnside, 6.ii.1966, *Bullock 54* (BR), idem cult. Nelspruit, 23.x.1965 (M); ibid. cult. Umtali, Nov. 1967, *Plowes 2481* (SRGH); Gladstone Farm, Matopos, cult. Burnside, xii.1965, *Bullock 46* (SRGH); Burnside near Bulawayo, various plants and dates, *Bullock 90* (BOL; K; SRGH), *90A* (K; LISC; SRGH), *90B* (PRE), *90C* (BM; G), *90D* (flowers yellow) (K; LISC; PRE; S; SRGH), *90E* (MAH; NBG; WIND), *90F* (B; COI; FHO; FI; KIEL; LISU; LMA; LUA; LUAI; MO; PUC; Z), *90G* (flowers variegated) (BOL; K; LISC; M; NBG; PRE; SRGH; WIND), *90H* (flowers yellow) (BM; BOL; M; WIND). Without precise locality, *Wilman* s.n. (K).

SOUTH AFRICA. Transvaal, 2231 (Pafuri), Punda Maria (-AC), iii.1933, *Lang* in Herb. Transv. Mus. *31804* (PRE).

2329 (Pietersburg), 8 mls. N of Pietersburg (-CD), cult. Greendale, 24.xii. 1969, *Bey 47* (SRGH); 6 mls. E of Pietersburg (-CD), cult. Turfloop, 22.ii.1964, *Van Vuuren 1653* (PRE); 15 mls. E of Pietersburg (-DC), cult. Greendale, 15.ii.1960, *Leach 9770* (PRE; SRGH).

2331 (Phalaborwa), Letaba (-DC), 27.iii.1933, *Lang* in Herb. Transv. Mus. *30618* (PRE), ibid. ix.1933, *Lang* s.n. (PRE).

2428 (Nylstroom), Naboomspruit (-DA), *Stent* in Nat. Herb. *11373* (PRE).

2525 (Mafeking), between Zeerust and Gaberones, iii.1934, *Van Son* s.n. (PRE).

2526 (Zeerust), Zeerust, *Knobel* s.n. (PRE); Zeerust, cult. Pretoria, *Leendertz* in Herb. Transv. Mus. *12785* (PRE), ibid. *Pott 4354* (GRA), ibid. ii.1919, *Rogers 22724* (Z); ibid. i.1928, *Thode A1446* (PRE).

2527 (Rustenburg), Northam (-AA), cult. Nelspruit, *Bayliss* in *Leach 11990* (SRGH); Sanadu (-DD), 10.iii.1933, *Brain 10375* (SRGH); Brits (-D), 6. iv.1935, *Mogg 14646* (PRE), ibid. 29.iii.1927, *Nouhuys 6* (PRE).

2528 (Pretoria), 3 mls. E of Hammanskraal (-AD), cult. Nelspruit, 8.ii.1964, *L. & B. 12065* (SRGH; Z); 20 mls. N of Pretoria, near Rooiplaat (-AD), 7.x.1937, *Erens 449* (PRE); Pienaars River, Hammanskraal (-A), 27.iii.1933, *White* in Herb. Transv. Mus. *31803* (PRE); Pienaars River (-A), 18.iii.1933, *Schweickerdt 1059* (COI; PRE); Pretoria (-C), 25.ii.1949, *Anderson* s.n. (NBG); Wonderboom, cult. Pretoria, *Pott* in Herb. Transv. Mus. *19211* (PRE), ibid. 13.iv.1951, *Reyburn* s.n. (PRE).

2531 (Komatipoort), Sabi Riv., 1 ml. E of Skukusa (-BA), 4.v.1949, *Codd 5487* (PRE), idem, cult. PRE, iv.1952 (PRE; SRGH).

2724 (Tuang), Kameelpan, Christiana (-DD), 10.i.1934, *Theron 523* (PRE).

2726 (Odendalsrus), 8 mls. S of Makwassie (-AC), cult. Turfloop, 10.ii.1964, *Van Vuuren 1653* (PRE).

Without precise locality: "Transvaal" *Holub* (K); "From the Transvaal country" *Sanderson* s.n. (BOL; K).

O.F.S. 2627 (Potchefstroom), near Parys (-CD), *Malcolm* in Herb. Moss. *19622* (J).

2825 (Boshof) Klippiespan Farm (-C), cult. NBG 149/43, 18.ii.1943, *Harris* s.n. (NBG).

2826 (Brandfort), Brandfort (-CB), cult. NBG 520/54, 12.iii.1956, *Hall* s.n. (NBG).

2925 (Jagersfontein), Fauresmith Bot. Res. (-DA), fl. v.1927, fr. x.1927, *Smith 3957A* (PRE); Fauresmith, *Dyer 1923* (GRA), 26.i.1930, *Henrici 1958* (PRE), ibid. cult. PRE, iii.1930 *Nouhuys* in Nat. Herb. 8459 (PRE), ibid. i.1928, *Smith 5253* & *5591* (PRE).

2926 (Bloemfontein), Bloemfontein (-AA), 6.ii.1966, *Hanekom 562* (PRE); ibid. *Pott 391* (BOL) and *Pott 392* (GRA).

Natal, 2829 (Harrismith), Ladysmith (-DB), cult. NBG 329/46, 14.iii.1949, *Morton* s.n. (NBG).

2830 (Dundee), Weenen (-CC), 24.ii.1965, *Moll 1671* (PRE), iii.1914, Herb. Justus Thode in Herb. Stellenbosch *2606* (STE); between Greytown and Keats Drift (-DC), xii.1935, *Reynolds 1713* (PRE).

2831 (Nkandla), Eshowe, 22.iii.1938, *McLoughlin* s.n. (PRE).

Cape: 2525 (Mafeking), Pitsani Farm (-CC), cult. NBG 401/59, 29.iii.1962, *Cole* s.n. (NBG); ± 3 mls. S of Ramathlabama (-DA), cult. Nelspruit, *L. & B.*

12444 (B; BM; BR; COI; G; K; KIEL; KMG; M; NBG; PRE; SRGH); ± 3 mls. SE of Mafeking (-DC), cult. Nelspruit, *L. & B. 12443* (BOL; LISC; ZSS); Rooigrond (-DC), cult. Nelspruit, i.1965, *Bayliss 2032* (NBG; PUC; STE); Mafeking (-DC), iii.1907, *Marloth 4377* (K).

2624 (Vryburg), Vryburg (-D), cult. *Pillans* 49, *Fry* s.n. (BOL; K).

2722 (Olifantshoek), Olifantshoek (-DD), cult. Nelspruit, Jan. 1968, *L. & C. 13803A* (K; S), *13803B* (K; S).

2724 (Taung), Taungs Native Res. (-DA), 26.ii.1946, *Brueckner* s.n. (PRE); W of Harz Riv. (DB), *Rodin 3623* (BOL; K); Buxton (-D), ii.1948, *Brueckner 1209* (PRE).

2824 (Kimberley), Warrenton, (-BB), *Adams* s.n. (GRA); 4 mls. SW of Warrenton (-BB), 13.ii.1959, *Leistner 1256* (PRE); ½ ml. S of Holpan P.O. (-DA), cult. PRE, i.1960, *Leistner 1415* (PRE); Klip Drift (Barkly West) (-DA), *Tuck* in Herb. MacOwan *2240* (G; K; PRE), idem ?Dutoitspan (SAM), idem, cult. *MacOwan* (K); Spytfontein, ± 8 mls. from Kimberley (-DC), iii.1933, *Schweickerdt 1119a* (PRE); Dutoitspan (-DD), v.1875, *Barkly 40* (K); Kimberley (-D), *Bolus 268* (BOL); ibid. 19.iii.1906, *Galpin 7358* (GRA; PRE); 27.iii.1953; ibid. *Hall 656* (NBG), *Rehmann 3480* (Z), *Wilman 1177* (SAM); Griqualand West, *Bowker 7* (K).

2922 (Prieska), Prieska (-CB), *Marloth 3776* (PRE), *Bryant 878* (K); 7 mls. N of Prieska (-CB), cult. NBG 272/59, 23.ii.1960, *Hall 1689* (NBG); 15 mls. NW of Prieska (-CB), cult. PRE, *Schlieben 8794* (PRE).

2923 (Douglas), Mazelfontein (-BA), cult. Albany Mus., *Anderson* s.n. (GRA); Douglas (-BB), *Harries* in Herb. Galpin *6308* (PRE).

The distribution of this taxon, which seems to be exceptionally tolerant of widely differing edaphic and climatic conditions, extends from Natal to northern Botswana; its main concentration appearing to be in the northern Cape and south-eastern Botswana, where relatively densely populated colonies are frequently to be found. It is also reliably recorded from Mangulane in the Lourenço Marques District of Moçambique, but unfortunately no material appears to have been preserved nor has it again been collected from this area.

(1b). Subsp. **vaga** (N.E. Br.) Leach, stat. nov.

Stapelia vaga N.E. Br. in Kew Bull. **1895:** 265 (1895) et in Flora trop. Afr. **4**,1: 501 (1905).——Berger, Stap. ü. Klein.: 237 (1910).——Huber in Prodr. Fl. S.W. Afr. **114:** 62 (1967), pro parte excl. syn. *Caralluma lateritia* N.E. Br. et *C. lutea* var. *lateritia* (N.E. Br.) Nel.

Type: S.W. Africa, Ovamboland, *Schinz 2047* (K! Z!). The sheet at Kew is not numbered but there seems little doubt that it is, in fact, a duplicate of that at Zürich.

Caralluma nebrownii Berger in Notizbl. bot. Gart. Mus. Berl. **4:** 249 (1906) et Stap. ü. Klein.: 85 (1910).——N.E. Br. in Curtis's bot. Mag. **135:** t.8267 (1909).——Pearson in Ann. S. Afr. Mus. **9:** 183 (1912).——White & Sloane, Stap. **1:** 374 (1937).——Luckhoff, Stap. S. Afr.: 53, 65, 66 (1952).——Jacob., Handb. Succ. Pl. **1:** 252 (1960).

Type: S.W. Africa, Barmen, *Dinter 1502.*

There are several specimens at Kew which are labelled Type or Type Specimen, but judging from the various dates of publication, flowering etc. it seems probable that several plants were involved; however, on the evidence available it seems that the single flower labelled *Dinter* "Type specimen" may well be from Dinter's original gathering No. 1502.

Caralluma brownii Dinter et Berger in Dinter, Deutsch S.-W. Afr.: 113 (1909).

Caralluma pseudonebrownii Dinter, Neue Pfl. S.W. Afr.: 17 (1914).——Stapf in Curtis's bot. Mag. **149:** t.8982 (1924).

Type: S.W. Africa, Keetmanshoop, *Dinter 2598* (SAM!).

The type is stated to be "Keetmanshoop and Aus"; there are two sheets of this number in SAM: one "cult. Okahandja" without locality of origin and the other "Keetmanshoop cult. Okahandja". It seems that this second specimen should be selected as the lectotype.

Caralluma lutea sensu Wordsworth, Hutchinson, F. & L. Bolus in Ann. Bolus Herb. **3:** 26 (1923).

Caralluma nebrownii var. *pseudonebrownii* (Dinter) White & Sloane, op. cit. **1:** 377 (1937).——Luckhoff, op. cit.: 66 (1952).——Jacob. tom. cit.: 252 (1960).

Type: As for *Caralluma pseudonebrownii* Dinter.

Caralluma vaga (N.E. Br.) White & Sloane, op. cit. **1:** 381 (1937).——Jacob., tom. cit.: 257 (1960).

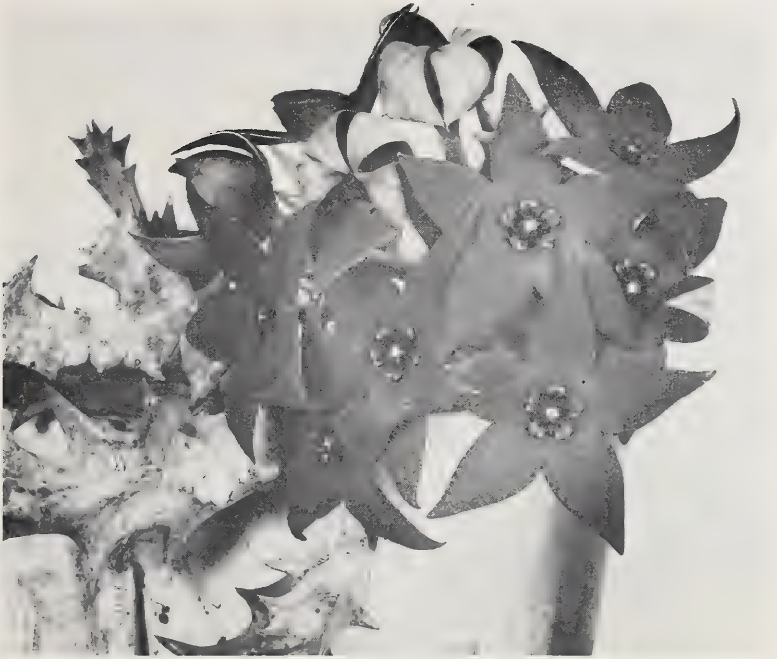
Type: As for *Stapelia vaga* N.E. Br.

Caralluma nebrownii var. *discolor* Nel in White & Sloane, Stap. **1:** 380 et **3:** 1144 (1937).——Jacob., tom. cit.: 252 (1960).

Type: S.W. Africa, Tsamap, *Rusch* in Herb. Stellenbosch *7366* (STE!).

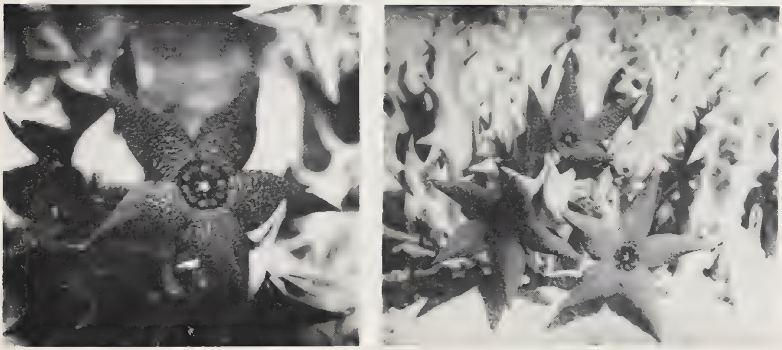
Caralluma hahnii Nel in White & Sloane, op. cit. **3:** 1164 (1937).——Jacob., tom. cit.: 246 (1960).

Type: S.W. Africa, Ovamboland, Ondonga (?Ondangua), No. *7364* in Herb. Stellenbosch (STE†).



Leach & Cannell 14039 B.
Plant from near Cahama, Huila Distr., S. Angola, flowering at PRE, flowers blackish maroon.

Photo by kind permission of Chief, Botanical Research Institute, Pretoria



Leach & Cannell 14039C
Plant from near Cahama; flowers maroon with pale pinkish flecks.

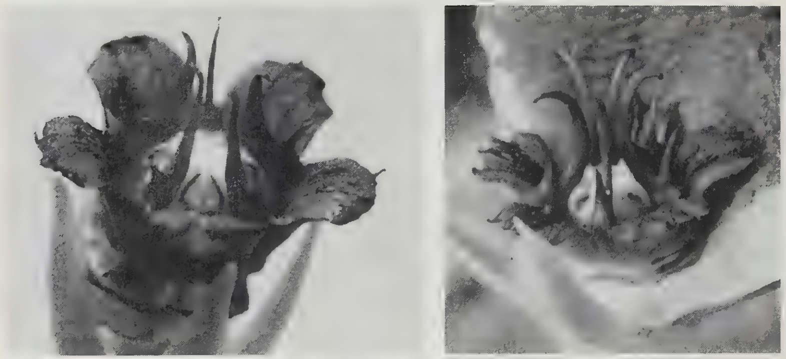
Leach & Bayliss 13052
Plant from near Ondangua, Ovamboland with reddish maroon flowers with minute yellow dots.

Photos L. C. Leach

FIG. 5. *Caralluma lutea* N.E. Br. subsp. *vaga* (N.E. Br.) Leach

The type material has not been traced and is assumed to have been lost or destroyed. The description and figure in White & Sloane (*l.c.*) does not, however, appear to differ from that of subsp. *vaga* which is known to be plentiful around Ondangua, moreover no other taxa belonging in this group are known to occur in Ovamboland; *C. hahnii* has therefore been placed in synonymy.

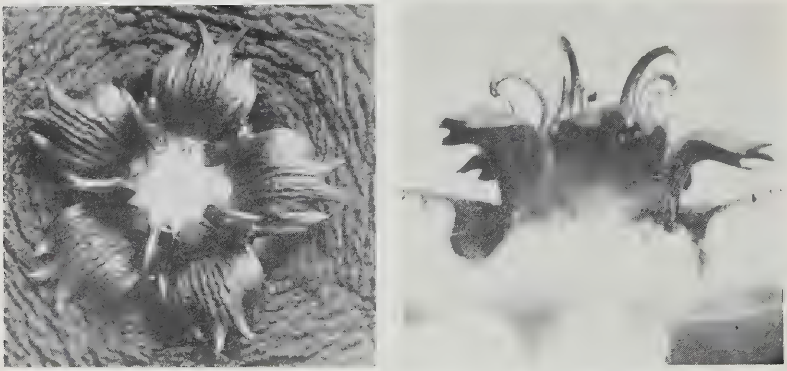
Subsp. *vaga* is distinguished by its proportionally much broader corolla lobes which are normally about 1·5 to 2·5 times as long as broad. As previously



Plowes 1943
Lucydale Farm, Matopos, Rhodesia.

Plowes 1529
Nyamandhlovu, Rhodesia.

Showing extremes of variation in corona lobes of *Caralluma lutea* N.E. Br. subsp. *lutea*.



Leach & Bayliss 13034B

FIG. 6. *Caralluma lutea* N.E. Br. subsp. *vaga* (N.E. Br.) Leach.

Ondangua, Ovamboland. Shewing extreme form of corona which is, however, quite comparable with *Plowes* 1529 above.

Photos by courtesy of Mr. D. C. H. Plowes mentioned, a few specimens from the S.W. African intermediate forms fall within the range of ratios (corolla length/width) of subsp. *lutea*, but these are considered to lend support to rather than to upset the taxonomic conclusions now reached.

ANGOLA. Huila District, ± 4 mls. SE of Cahama, cult. Nelspruit, *L. & C. 14039A* (M; S; SRGH; WIND), *14039B* (K; LUA; LUAI; PRE), *14039C* (BM; LISC); Seedlings from seed gathered ± 4 mls. SE of Cahama, cult. SRGH, 1969, *14039Aa* (BOL; BR; COI; KIEL; FI; MO; ZSS), *14039Ba* (LISU), *14039Ca* (K; LISC; PRE; SRGH).

S.W. AFRICA. 1715 (Ondangua), Ondangua (-DD), 5.ii.1959, *De Winter & Giess 6880* (PRE; SRGH; WIND); ± 12 mls. N of Ondangua (-DD), cult. Nelspruit, *L. & B. 13041B* (PRE), *13041C* (K; MO), *13041D* (BM; BOL; LISC; LUA; LUAI; M; SRGH; WIND); ± 5 mls. N of Ondangua (-DD), cult. Nelspruit, *L. & B. 13035* (BR; G; M; NBG; LISJC; LMA; Z); ± 3 mls. N of Ondangua (-DD), cult. Nelspruit, *L. & B. 13034A* (B; COI; FHO; FI; MAH; PUC), *13034B* (BM; GRA; LISU; STE; SRGH), idem cult. Umtali, in *Plowes* (SRGH), *13034C* (BOL), *13034D* (K; LUA; LUAI; PRE).

1716 (Enana), Olukonda (-CC), 15.i.1886, *Schinz 2047* (K; Z), ibid. fr. 14.x.1885, *Schinz 2042* (Z); ?1716 (Enana), Onkumbi, fr. ix.1885, *Schinz 2041* (Z).

1816 (Namutoni), ± 10 mls. SE of Ondangua (-AA), cult. Nelspruit, *L. & B. 13032* (G; KIEL; LISC; LUA; LUAI; NBG; WIND); *L. & B. 13052* (MO; ZSS); ± 20 mls. SE of Ondangua (-AA), cult. Nelspruit, *L. & B. 13054* (K; PRE; SRGH); ± 25 mls. SE of Ondangua (-AB), cult. Nelspruit, *L. & B. 13031* (BM; BR; LISC; M; SRGH; WIND); ± 35 mls. SE of Ondangua (-AD), cult. Nelspruit, *L. & B. 13029* (BOL; K; PRE); Etosha Pan, fr. vii.1899, *Dinter* s.n. (Z); ibid. cult. Umtali, 24.ii.1969, *Braine* in *Plowes* 2923 (SRGH).

2115 (Karibib), Omaruru (-BD), 2.iv.1936, *Triebner* s.n. (PRE); Farm Klein Spitzkop, SW70 (-CC), 23.iii.1965, *Giess & Hardy 8470* (WIND); between Grosse & Klein Spitzkop, (-CC), 27.iii.1965, *Hardy 2150* (PRE).

2216 (Otjimbingwe), Otjiswa (Otjisewa) (-BD), 16.iii.1899, *Dinter ?488* (Z); Khomas Hochland, Farm Friedenau (-DB), 22.iii.1955, *De Winter 2586* (PRE; WIND).

2217 (Windhoek), Windhoek (-CA), cult. NBG 699/31, i.1932, *Bosch* s.n. (BOL); ibid. 25.iii.1964, *Homann* in *Giess 7814* (WIND); Rehoboth N, Farm Bergland (-CC), cult, Windhoek, iv.1959, *Giess 1990* (WIND).

2218 (Gobabis), Gobabis (-DB), iii.1966, *Tölken 1079* (PRE).

2316 (Nauchas), Rehoboth W, Farm Isabis (-AD), cult. Windhoek, iv.1959, *Giess* s.n. (WIND); Nauchas (-CB), 3.i.1916, *Pearson 9499* (BOL; K).

2317 (Rehoboth), Rehoboth (-AC), *Triebner* s.n. (PRE).

2617 (Bethanie) Kuibis (-CA), cult. NBG 425/55, 5.iv.1957, *Hall* s.n. (NBG).

2618 (Keetmanshoop), Keetmanshoop (-CA), xii.1909, *Dinter 2255* (SAM), cult. Okahandja, *Dinter 2598* (SAM).

2717 (Chamaites), Inachab (-CA), fl. & fr. xi.1897, *Dinter 1056* (Z); Gorges (-CB), cult. NBG 1997/16 et 2599/16, del. *Page* (BOL).

2718 (Grünau), Gründoorn (-AD), 4.ii.1909, *Pearson 4350* (BOL; K) Klein Karas (-CA), cult. NBG 744/28, 14.iii.1929, *Hill* s.n. (BOL).

2819 (Ariamsvlei), Tsamap (AA), *Rusch* s.n. (STE).

Without precise locality: *Elwes* s.n., fig. in Bot. Mag. t.8982 (K); Hort. Hanbury, 1907 "from the type plant" (K). *Dinter* s.n. (?1502) "Type specimen" (K); Kalkfontein South (probably near Karasburg or possibly near Grootfontein), *Coppens* s.n. (PRE).

S. Africa. Cape, 2820 (Kakamas), Keimoes (-DB), *Strey 3882* (PRE); Kakamas (-DC), cult. NBG 417/40, 6.v.1941, (NBG).

Although fruiting specimens only and therefore not certainly identifiable, *Schinz 2041* and *2042* from Ovamboland and *Dinter* s.n., Etosha Pan, have been included on the evidence of their vegetative characteristics and the localities (the two former particularly as these were cited by Berger under *C. nebrownii* in his monograph of 1910).

Distribution of this subspecies appears to be restricted to S.W. Africa and some neighbouring areas of S. Africa in the vicinity of Kakamas and Upington just south of the Orange River, and to southern Angola in the southern portion of Huila District adjacent to Ovamboland, in which latter territory the most densely populated concentrations appear to occur.

Whether evolutionary development of the species has taken place along the "lutea-vaga" axis or whether the present situation results from a once more widespread distribution, with perhaps a more or less centrally situated origin of which the present extremely variable intermediate populations are relictual is open to question. It does appear to the writer however, in view of the overall similarity of coronal form, that hybridisation is unlikely to have been responsible.

2. Caralluma albocastanea (Marl.) Leach, comb. nov.

Stapelia albocastanea Marl. in Trans. Roy. Soc. S. Afr. **3:** 124 (1913).——Dinter, Neue Pfl. S.W. Afr.: 50, t.38 (1914).——F. & L. Bolus & R. Glover, Ann. Bolus Herb. **1:** 75 (1915).——Dinter in Feddes Rep. **23:** 365 (1927).——Marl. Fl. S. Afr. **3**,1: 99, t.23F. (1932).——White & Sloane, Stap. **2:** 524 (1937).——Jacob., Handb. Succ. Pl. **2:** 850 (1960).——Huber in Prodr. Fl. S.W. Afr. **114:** 62 (1967).

Type: S.W. Africa, Maltahöhe, *Marloth 5110* (PRE!).

Stapelia caroli-schmidtii Dinter et Berger in Engl., Bot. Jb. **50,** Suppl.: 592 (1914).

Type: S.W. Africa, Bullspoort Flats, Karas Mountains, *Dinter 2105*.

In the shape and particularly in the granulate texture of its corolla, in the construction of its corona, especially of the inner lobes, and perhaps most significantly, in the shape of its pollinia, *C. albocastanea* appears clearly to belong in the "lutea group", and with *C. lutea* accepted in *Caralluma* the new combination becomes virtually obligatory.

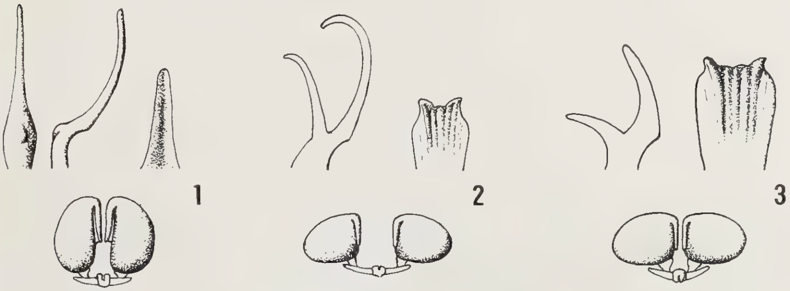


FIG. 7. Comparison of corona lobes and pollinia.
Corona lobes × 5 approx. Pollinia × 15 approx.

1. *Stapelia jucunda* N.E. Br., *Haagner* s.n. Williston, Cape.
2. *Caralluma albocastanea* (Marl.) Leach, *Marloth* 5001, Maltahöhe.
3. *Caralluma knobelii* (Phillips) Phillips, *Bulawayo Mus*. s.n. Sekhuma Pan, SE Botswana.

In this connection it may be pertinent to note that although there has, in the past, been some uncertainty in respect of the generic placing of some members of the group, particularly e.g. of *C. melanantha*, there appears never to have been any doubt regarding that of *C. lutea* which has remained firmly and unquestioned, and it seems justifiably, in *Caralluma* since it was first described by N. E. Brown in 1891.

When describing his species Marloth related it to *Stapelia jucunda* N.E. Br. but this relationship does not appear to be very close; in particular, the corona form, pollinia shape and the texture of the corolla are all quite different (see fig.), the resemblance appearing to lie mainly in the marking and colouring of the corolla.

S.W. AFRICA: 2416 (Maltahöhe), near Maltahöhe, cult. Cape Town, fl. March 1912, *Marloth 5510* (PRE).

2718 (Grunau), Narudas Süd, Great Karasberg (-B), 7.i.1913, *Pearson 8471* (PRE).

Although *C. albocastanea* and *C. knobelii* are apparently very closely related it is considered that the discontinuities apparent, at least at our present level of knowledge of their distribution and variation, are sufficient to warrant the retention of specific status for these two taxa.

The habit of *C. albocastanea* with its spreading, tufted, above-ground growth form and more widely spaced succession of smaller flowers borne on much longer pedicels, appears to be quite different from that of *C. knobelii* which has developed a partially subterranean habit with underground stems giving rise to plantlets, often at some little distance from the parent plant, after the manner of *C. maculata* N.E. Br. The smaller flowers of *C. albocastanea* with proportionally narrower corolla lobes, usually about twice as long as broad, are borne on long pedicels, the shortest of which, according to the records, is longer than the longest (var. *langii*) seen or recorded for *C. knobelii*. The two horns of the inner corona lobes of *C. albocastanea* are not only generally longer than those of its relative but are more nearly equal in length, with the sub-erectly spreading outer horn usually almost as long as the inner, as opposed to the more subhorizontally spreading, shorter horn of *C. knobelii*. The outer corona lobes of the S.W. African species are also very much smaller than those of any other taxa belonging in this group.

A further distinction lies in the attachment of the pollinia to the carrier; when the pollinia are pressed flat while still attached to the carrier, they appear to be attached near the ends of the wings, so leaving a space ($\pm 0 \cdot 3$ mm) between the pollinia. This arrangement has not been noted in any of the closely related taxa and, within the limits of the admittedly limited material examined, appears to be constant for the species.

The ground colour of the corolla appears to be somewhat variable, being described as: white or creamy (Marloth), light grey (Pearson) and dull green (Jacobsen) while the markings are said to range from brown or dull red to almost blackish purple.

3. Caralluma knobelii (Phillips) Phillips in Flower. Pl. S. Afr. **15:** t.593 (1935).——White & Sloane, Stap. **1:** 366 (1937).——Luckhoff, Stap. S. Afr.: 64 (1952).——Story, Pl. Bushmen Food, S. Afr. Bot. Survey **30:** 42, t.47 (1958).——Jacob., Handb. Succ. Pl. **1:** 248 (1960).——Leistner, Pl. Ecol. S. Kalahari, S. Afr. Bot. Survey **38:** 57 etc. (1967).

Type: Botswana, *Knobel* s.n. No. 8308 in PRE (PRE!).

Stapelia knobelii Phillips, op. cit. **10:** 363 (1930).

Type: As for *Caralluma knobelii*.

Caralluma langii White & Sloane Stap. Ed. 1: 61 (1933).

Type: Botswana, Gaberones, *Van Son* s.n.

Caralluma knobelii var. *langii* (White & Sloane) White & Sloane, tom. cit.: 368 (1937).——Jacobsen, tom. cit.: 248 (1960).

Type: As for *Caralluma langii.*

Caralluma kalaharica Nel in White & Sloane, op. cit. **3:** 1165 (1937).——Jacob., tom. cit.: 247 (1960).

Type: Botswana, Tsau (NW of Lake Ngami), *Nel* s.n. cult. *Triebner 2105* (STE†).

Its smaller distinctively coloured flowers with proportionally much wider corolla lobes as well as its different habit immediately distinguish this species from the related *C. lutea* subsp. *lutea* with which it shares a portion of its distribution.

The corona of *C. knobelii* differs from those of all its near relatives in that the outer horn of the inner corona lobes is more widely, often more or less

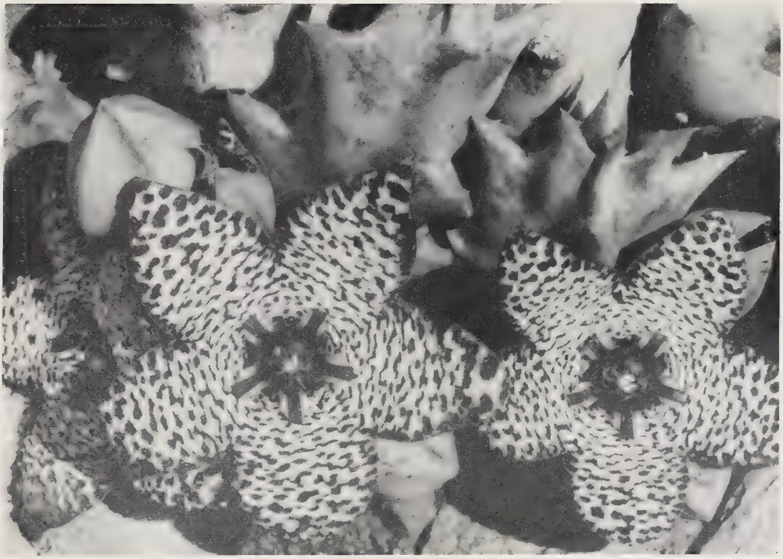


Fig. 8. *Caralluma knobelii* (Phillips) Phillips.
Typical flowers with striped outer corona lobes. Origin unknown.

Photo. Herbert Lang, by courtesy of Chief, Botanical Research Institute, Pretoria horizontally spreading, as opposed to the more usual erect or suberect arrangement. Its nearest relationship however, appears to be with *C. albocastanea* and this is discussed under that species.

C. kalaharica Nel has been placed in synonymy, as although spatially distant from the assumed type locality of *C. knobelii* it appears to occur in the same general ecological and distributional area occupied by that species, while from the description (it is unfortunate that the type material appears to have been lost or destroyed) it does not seem to differ materially from typical *C. knobelii.* Furthermore, in view of the opinion of White & Sloane (*l.c.*) that morphologically it falls between the typical variety and var. *langii*, it seems quite illogical to accept it as being specifically distinct.

Var. *langii* is also considered to be synonymous as although apparently more distinct than Nel's species it seems to fall well within the range of variability accepted for the group and which appears to be equally wide within *C. knobelii* (e.g. *Leistner 2215* with corolla lobes as narrow or narrower than those of var. *langii*, and *Leistner 2080* with 4-6-angled stems).

Botswana. **SW.** Ghanzi, 25.vii.1955, *Story 5090* (PRE); between Kuke Pan and Kika Pan, xi.1956, *Story 4914* (PRE); Tsabong, *De Winter 7481* (PRE).

SE. 12·5 miles NW of Molepolole, 1.xii.1954, *Codd 8921* (PRE); Sekhuma Pan, cult. Bulawayo Mus. (SRGH).

S. Africa. Cape: 2622 (Tsabong), Kuruman Riv., *Leistner 2215* (PRE).

2721 (Tellery Pan), Kuruman Riv., 14 miles W of Gordonia/Kuruman border (-AB), 8.xi.1961, *Leistner 2226* (PRE).

2722 (Olifantshoek), Lang Pan (-CA), 9.xii.1960, *Leistner 2080* (K; PRE).

C. knobelii appears to be restricted to calcareous sandy soils of the Kalahari and is of rather rare occurrence; its rarity being contributed to, in all probability, by the fact that it is eaten by both humans and animals (as commented upon by both *Story l.c.* and *Leistner l.c.*). This appears to be in marked contrast to the closely related *C. lutea* of which large numbers of plants of both subspecies have been seen by the author in the vicinity of African villages in the south-eastern parts of Botswana and particularly in Ovamboland where plants in open situations on otherwise bare soil were often clearly visible for some distance. Whether or not this is due to a difference in palatability is not known.

4. Caralluma melanantha (Schlecht.) N.E. Br. in Fl. Cap. **4**,1: 885 (1909).—— White & Sloane, Stap. **1**: 354 (1937).——Gomes e Sousa in Moçambique **49**: 65 (1947).——Luckhoff, Stap. S. Afr.: 33 etc. (1952).——Jacobsen, Handb. Succ. Pl. **1**: 251 (1960).

Type: Transvaal, stony flats near Sandloop, *Schlechter 4694.*

Stapelia sp. Schlechter in Engl., Bot. Jb. **20:** 56 (1895).

Stapelia melanantha Schlechter, op. cit. **38:** 50 (1905).——Berger, Stap. ü. Klein.: 316 (1910).

Type: As for *Caralluma melanantha.*

Stapelia furcata N.E. Br. tom. cit.: 973 (1909).——Berger, op. cit.: 301 (1910).

Type: Transvaal, *Todd* s.n. (K!).

Caralluma leendertziae N.E. Br. in Ann. Transv. Mus. **2:** 47 (1909).——Phillips in Flower. Pl. S. Afr. **6:** t.224 (1926).

Type: Transvaal, Potgietersrust, *Leendertz 1279* (K!).

Caralluma rubiginosa Werdermann, Fedde. Rep. **30:** 54 (1932).——As "*f. rubiginosa*" White & Sloane, tom. cit.: 359 (1937).

Type: Hort. Berlin-Dahlem.

Caralluma australis Nel in White & Sloane, op. cit. **3:** 1153 (1937).

Type: Transvaal, Pietersburg Distr. *Kirsten* s.n., Hort. STE, No. 5881 (STE!).

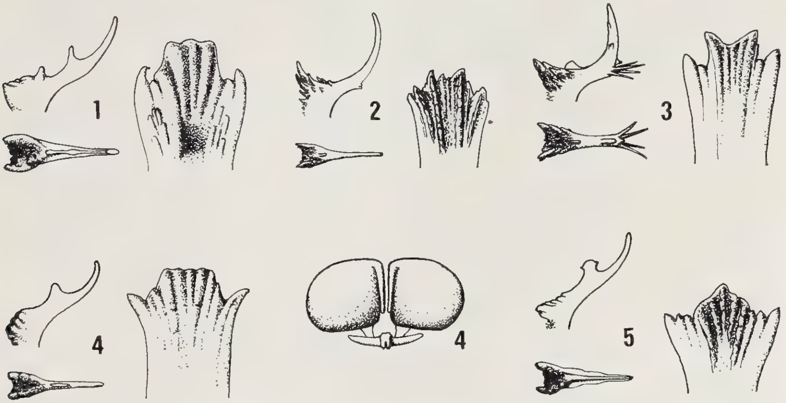


FIG. 9. *Caralluma melanantha* (Schlecht.) N.E. Br.

Corona lobes × 5 approx. Pollinia × 15 approx.

1. *Leach* 9756, Smits Drift, Boyne, N. Transvaal.
2. *Leach* 12261 ± 10 mls. N. of Moamba, Lourenço Marques Distr., Moçambique.
3. Operation Wild Fl. in *Leach* 13283 Roossenekal, E. Transvaal.
4. *Leach* 9757, Bandolier Kop, N. Transvaal—shewing typically subquadrate pollinia.
5. *STE* 5881 Witputs, N. Transvaal—Type of *C. australis* Nel.

Caralluma melanantha var. *sousae* Gomes e Sousa in Moçambique **4:** 46 (1935).——White & Sloane, op. cit. **1:** 357 (1937).——Jacob. tom. cit.: 251 (1960).

Type: Moçambique, Lourenço Marques Distr., Mangulane.

Caralluma melanantha is an exceedingly variable species, particularly in respect of the inner lobes of the corona; no two specimens examined have been identical in coronal characters, while colouration, hairiness and flower size are almost equally variable. The species is, nevertheless, almost always immediately recognisable; it is, incidentally, one of the few species in the genus which may, with reasonable certainty, be identified from its stems.

The type material of *C. australis* Nel appears to fall well within the range of variation discussed above and is accordingly placed in synonymy, as also is var. *sousae* which appears to be merely another of the many individual variants,

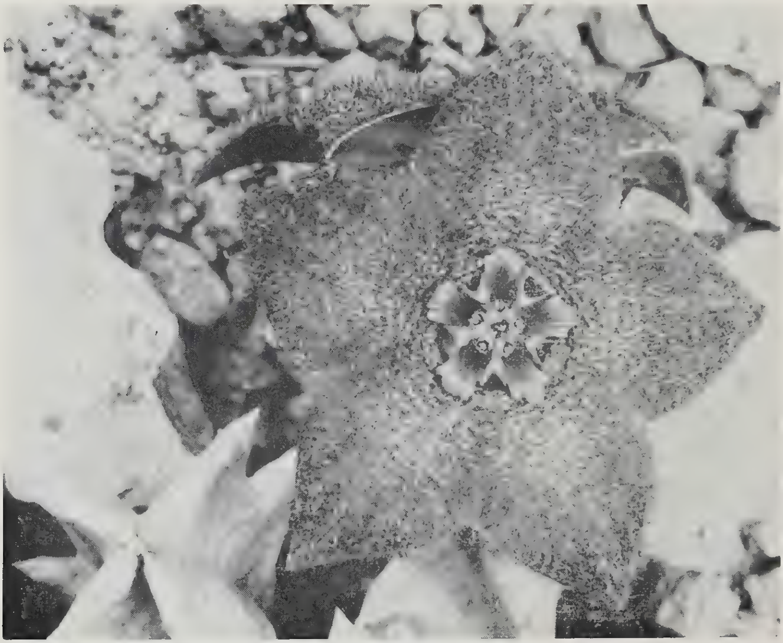


Fig. 10. *Caralluma melanantha* (Schlecht.) N.E. Br.
Corona with typical inner lobes deeply excavated at the base; corolla densely hairy. Origin unknown, cult. Transvaal Museum.

Photo. Herbert Lang, by courtesy of Chief, Botanical Research Institute, Pretoria inasmuch as another specimen from the same area differs from the variety to as great an extent as it does from individual specimens from the Transvaal.

MOÇAMBIQUE. **SS**: Between Mapinhane and Mavume, March 1936, *A. Gomes e Sousa* s.n. (Photo. SRGH).

LM: Lourenço Marques Distr., cult. PRE, 4.iii.1963, *I.I.C.M. 13* (PRE); between Marracuene and Boane, 17.iii.1945, *E. de Sousa 79* (LISC; PRE); ± 10 mls. N of Moamba, cult. Nelspruit, *Leach 12261* (BM; BOL; BR; K; LISC; LMA; M; NBG; PRE; SRGH).

SOUTH AFRICA. Transvaal: ?2327 (Ellisras), Rhenosterhoek, Waterberg Distr. (-DD), cult. PRE 10196, ii.1952, photo., *Van Vuuren* s.n. (PRE).

2328 (Baltimore), Blauwberg (-BB), cult. PRE, ii.1955, *Codd 8777* (K; PRE); Mohlakeng Plateau, Blauwberg (-BB), 13.i.1955, *Codd & Dyer 9110* (PRE); Kwarriehoek (-CD), *Steyn 50* (PRE), *Steyn 80* (PRE).

2329 (Pietersburg), Van Wyksput (-AC), cult. STE, iii.1936, *Kirsten* in STE, *(M) 662* (STE); Louis Trichardt (-BA), 18.ii.1960, *Schlieben & Strey 8365* (PRE); Bandolierkop (-BC), cult. Greendale, 3.ii.1960, *Leach 9757* (K; KIEL; LMA; PRE; SRGH); Pietersburg Town Lands (-CD), iii.1935, *Kirsten 2* (PRE); Munnik (-DB), cult. PRE, i.1937, *Coaton & Hattingh* s.n. (PRE); 6 mls. E of Pietersburg (-DC), cult. Turfloop, 22.ii.1964, *Van Vuuren 1652* (PRE); 24 mls. E of Pietersburg, Smits Drift (-DD), 4.i.1948, *Bruce & Kies 53* (PRE); ibid. (-DD), 6.ii.1960, *Leach 9756* (G; SRGH); Boyne (-DD), cult. Umtali, 18.ii.1969, *Plowes 2634* (SRGH); Pietersburg Distr., iii.1935, *Kirsten 4* (PRE); Pietersburg, cult. PRE, iii.1919, *Munro* s.n. in Herb. Transv. Mus. *19732* (PRE).

2330 (Tzaneen), Ephrata near Elim (-AA), *Obermeyer* in Herb. Transv. Mus. *30617* (PRE); between Mokeetsi and Ellerton Mine, Duivelskloof, 26.viii.1945, *Graham* s.n. (PRE).

2427 (Thabazimbi), Hoopdal (-AD), 3.iii.1948, *Codd 3722* (PRE).

2428 (Nylstroom); Potgietersrust, "in the bush", ix.1908, *Leendertz 1279* (K), idem, cult. PRE, iii.1911 (K).

2429 (Zebediela), Pyramid Estate (-AA), 1.iii.1921, *Galpin 9030* (PRE); near Nebo (-DD), cult. Nelspruit, 14.ii.1964, *L. & B. 12083* (K; PRE; SRGH); Gompies Riv., Zebediela Estates, iii.1935, *Kirsten 3* (PRE); near Haenertsburg, 28.iii.1929, *Repton 6A* (PRE); Marabastad, cult. PRE, ii.1931, *Van Son* in Herb. Transv. Mus. *28273* (PRE).

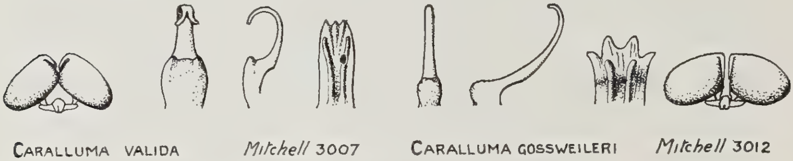
2528 (Pretoria), 2 mls. N of Hammanskraal (-AD), 4.i.1948, *Kies & Bruce 32* (PRE); Onderstepoort (-CA), 28.xii.1943, *Rossouw* s.n. (PRE); Derdepoort (-CB), 3.iv.1949, *Robertson 17* (PRE), ibid. 15.ix.1952, *Robertson 133* (PRE).

2529 (Witbank), Rossenekal, cult. Nelspruit, i.1968, Op. Wild. Flow. in *Leach 13283* (PRE); Selons Riv., cult. Johannesburg, 24.iii.1936, *Reynolds 769* (PRE).

Without precise locality: Sekukuniland, 11.iii.1935, *Barnard 278* (PRE); "From the Transvaal" *Todd* s.n. comm. *J. M. Wood* (K), del. *Schweickerdt* (PRE).

The main distribution of this species is, according to the records, generally at rather higher altitudes (3,500 ft. to over 5,000 ft.) mainly in the Transvaal; the somewhat disjunct occurrence in southern Moçambique at low altitudes (well below 1,000 ft.) is therefore somewhat surprising. However, despite the altitudinal difference in habitat there seems to be no character or combination of characters on which these specimens can be separated from those from the Transvaal.

The occurrence of this species near Bulawayo, Rhodesia, as listed by White & Sloane (*l.c.*), appears almost certainly to be based on the misidentification of the dark flowered form of *C. lutea* subsp. *lutea* which is plentiful in the Matopos area and, it is thought, may well have originated in a tentative identification of an *Eyles* gathering from the Matopos.



Corona lobes × 5 approx. Pollinia × 15 approx.

FIG. 11. A comparison of corona lobes and pollinia of *Caralluma valida* N.E. Br. and *Caralluma gossweileri* S. Moore.

5. Caralluma valida N.E. Br. in Kew Bull. **1895:** 264 (1895) et in Flora trop. Afr. **4**,2: 486 (1902).——Berger, Stap. ü. Klein.: 89 (1910).——White & Sloane, Stapelieae **1:** 382 (1937).——Jacob., Handb. Succ. Pl. **1:** 257 (1960).——Leach in Jl S. Afr. Bot. **31:** 241 (1965).

Type: ?Botswana, *Holub* s.n. (K!).

S.W. AFRICA. Caprivi Strip, Mutsiku, 5 mls. E of Bagani, cult. Windhoek, 2.iii.1966, *Kohler* s.n. in *Giess 9207* (WIND).

?BOTSWANA. Without locality, *Holub* s.n. (K).

ZAMBIA. **B:** Shangambo (Siwelewele), cult. PRE, 8.i.1953, *Codd 7485* (PRE). **S:** Mazabuka Distr., Siamambo For. Res., 27.xi.1960, *White 7420* (FHO; SRGH); Livingstone Distr., Katambora For. Extn., cult. Livingstone, *Bainbridge 1017* (FHO; NDO; PRE; SRGH), idem cult. SRGH (BM; BOL; K; LISC;

LUAI); Dambwa For. Res., cult. SRGH, iii.1966, *Mitchell 3007* (K; M; NDO; PRE; SRGH), idem cult. Nelspruit, 16.i.1968 (LISC; ZSS).

RHODESIA. **N:** Gokwe Distr. Charama Plateau, *Bingham 762* (SRGH), idem cult. Gokwe, *Bingham 762a* (SRGH).

W: Matobo Distr., cult. *Plowes 2454* (K; LISC); Lupane Distr., Bembesi Riv., cult. Greendale, xii.1960, *Leach 5811* (K; PRE; SRGH); ibid., ii.1965, *Walter 10* (SRGH), idem, cult. SRGH (K).

SOUTH AFRICA. ?Transvaal, ?Messina, cult. Messina, *Thompson* s.n. (PRE).

C. valida is gradually becoming better known and seems, although apparently closely related, to be specifically distinct from *C. huillensis* and *C. gossweileri* while being closest to *C. tsumebensis*, which species should possibly be considered to be separated only at varietal level; details of this relationship are discussed under the latter species.

From both the former *C. valida* may be readily distinguished by its smaller flowers and narrowly triangular (rather than narrowly ovate-attenuate or linear-attenuate), corolla lobes, while the pubescence (usually associated with short bristle-like hairs not known to occur in the related spp.) of the corolla inner surface is much coarser than that of either *C. huillensis* or *C. gossweileri*. The corona of *C. valida*, although very variable in the actual shapes of the lobes, is of a characteristically erect form (which is quite different from the more spreading habit of those of its congeners), which causes both the pollinia and the stigmatic cavity to be very inaccessible by comparison with those of any of the other taxa discussed (unfortunately such characters are usually destroyed when specimens are pressed). Finally the pollinia are a somewhat different shape and being attached to the carrier at about the mid-point of their inner margin are set at quite a different angle.

The distribution of *C. valida* to some extent overlaps that of *C. gossweileri* from which species it may additionally and most easily be recognised by the conspicuous ciliation of paper coloured vibratile hairs with which its corolla lobes are densely fringed.

6. Caralluma tsumebensis Oberm. in White & Sloane, Stap. **3:** 1163 (1937).—— Jacob., Handb. Succ. Pl. **1:** 256 (1960).

Type: S.W. Africa, Tsumeb, *Nägelsbach* s.n. in Herb. Transv. Mus. *32820* (PRE!).

S.W. AFRICA. 1917 (Tsumeb), Tsumeb (-B), cult. Pretoria, *Nägelsbach* s.n. in Herb. Transv. Mus. *32820* (PRE).

1920 (Tsumkwe), Gautscha Pan (-DC), *Story 5312* (PRE).

Apart from the specimen from Gautscha Pan, somewhat doubtfully included here, *C. tsumebensis* is known only from the type locality, in fact it seems possible that all examples from Tsumeb may be from one cultivated clone.

A series of excellent detailed sketches by Mr. W. Giess (unfortunately space will not permit the reproduction of the whole series) depicts a plant flowering in Oct. 1943, in cultivation at Andalusia near Kimberley; this plant also was brought from a Tsumeb garden and may well be a portion of Dr. Nägelsbach's original plant. These drawings show slight variations in the coronas of different flowers from the one inflorescence. The inner corona lobes, which are usually more or less subhorizontally incumbent on the anthers, appear to be reminiscent of those of *C. huillensis* as are also the spreading outer lobes; however the somewhat stipitate corona is, as a whole, considered to be rather closer to that of *C. valida* as also is the relatively small corolla which is, however, quite devoid of the conspicuous ciliation of that species. The pollinia, according to Mr. Giess's sketches, appear to be close to those of *C. valida*, particularly in respect of the point of attachment to the carrier; however, this similarity is to some extent offset by their relative accessibility as compared with that of the deeply set pollinia of *C. valida*.

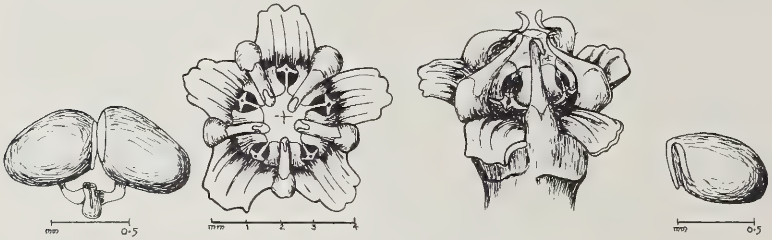


FIG. 12. *Caralluma tsumebensis* Oberm.
After pencil sketches by Mr. W. Giess, drawn from a plant from Tsumeb, S.W.A., flowering at Andalusia, N. Cape, S. Africa.

The stems of *C. tsumebensis* are stated to be 5-angled, but the pieces included in the type material give the impression of being 4-angled, as do those in a photograph by Dr. Nägelsbach, of a plant in cultivation at Tsumeb, as well as those depicted in Mr. Giess's sketch. A plant assumed to be this species (again obtained from a Tsumeb garden as recently as 1966) seen by the writer in cultivation in Mr. Giess's garden at Windhoek was also of the usual quadrangular pattern; unfortunately this plant died before flowering.

The red-flowered plant from Gautscha Pan, some 170 miles to the east of

Tsumeb, appears to be closest to *C. tsumebensis* despite its proportionally wider corolla lobes which are sparsely ciliate and has, therefore, been tentatively included here. In the photograph of this specimen the stems appear to be 5-angled.

It seems probable that both these specimens should be considered as being separable from *C. valida*, at most at varietal level, however, until authentic living, or at least, spirit material becomes available, the writer prefers to leave them under *C. tsumebensis*, especially in view of the element of doubt regarding the number of angles to the stems.

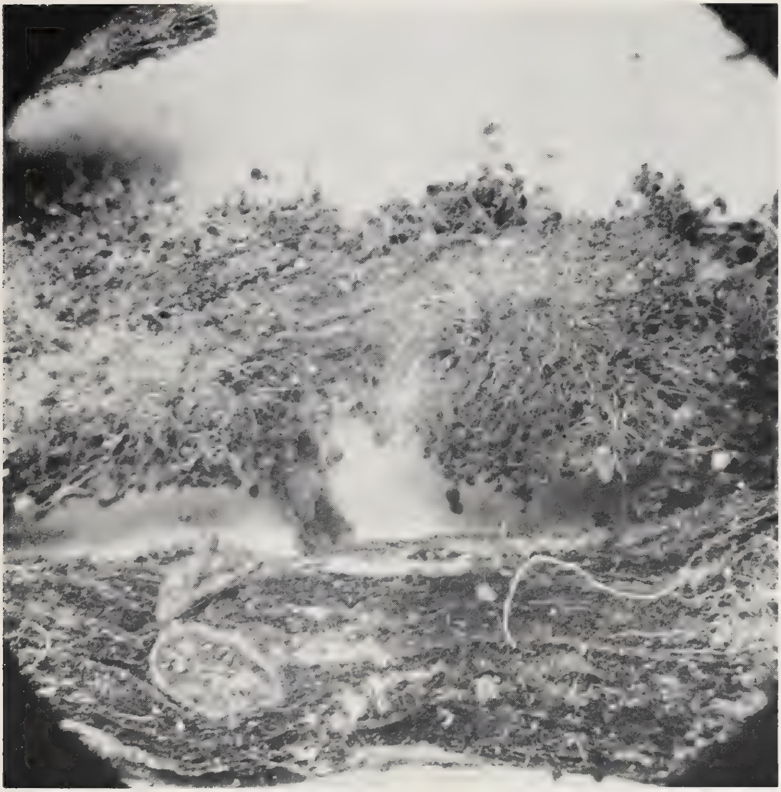


FIG. 13. *Mucor* sp. on stems of isotype material of *Caralluma huillensis* Hiern, *Welwitsch* 4266 (LISU).

Photo by courtesy of Dr. G. C. A. van der Westhuizen

7. Caralluma huillensis Hiern, Cat. Afr. Pl. Welw. **1:** 697 (1898).—— N.E. Br. in Flora trop. Afr. **4**,2: 487 (1903).——Berger, Stap. ü. Klein.: 88 (1910).—— White & Sloane, Stap. **1:** 347 (1937).

Type: Angola, Huilla, *Welwitsch 4266* (BM; LISU!).

In Hiern's description it is stated that the stems are obsoletely pubescent, and this supposed character, so unusual in the genus, has served to set *C. huillensis* apart from its near relatives. However, examination of the LISU specimen disclosed that the stems are, in fact, glabrous, although bearing patches of fungal hyphae; it has also been confirmed by Mr. J. F. M. Cannon of the British Museum, that the holotype is similarly glabrous and is also, to a slight extent, attacked by a fungoid growth.

I am much indebted to Dr. G. C. A. van der Westhuizen of the Plant Protection Research Institute, Pretoria for the following information and the photograph accompanying this article: "The fungus on this specimen is a *Mucor* sp. The fungus is overmature and cannot be identified to the species".

Caralluma torta N.E. Br. is the only other species in the genus which is described as having pubescent stems. In view of its small Ceropegia-like flowers one wonders if this plant does, in fact, belong in *Caralluma* or whether it would perhaps be more comfortably accommodated in *Ceropegia*, in which genus stem pubescence is not uncommon, while the twisted lobes and even the markings of the corolla of *C. torta* are certainly closely paralleled in *Ceropegia*.

It was primarily this reported pubescence of the stems which caused the writer, when discussing *C. gossweileri*, to relate that species to *C. valida* rather than to *C. huillensis*. However, now that the stems of the latter are known to be glabrous it is apparent that *C. huillensis* and *C. gossweileri* are very closely related indeed and may eventually prove to be conspecific.

None of the descriptions of *C. huillensis* mentions cilia; however, the two subsequent gatherings from Huila were found to possess clavate cilia and although none was observed in the LISU material a suspicion remained that *C. huillensis* might originally have been ciliate. Mr. Cannon, who has kindly examined the type specimen for this character also, has now confirmed that there are a few clavate cilia present as well as the short bristly remains of others, to be seen on one only of the flowers. From this it seems that *C. huillensis* is, in fact, ciliate, although it appears that the ciliation varies considerably in density and is possibly sometimes absent in individual flowers. These clavate vibratile hairs have often been recorded as readily caducous, consequently specimens from plants known to possess cilia may often appear to be without or to be only sparsely ciliate, dependent to some extent on age and the amount of handling to which the specimen has been subjected.

ANGOLA. Huila Distr., Humpata, 1800 m alt. *Gossweiler 12612* (LISC); Huila, "arredores da Missão de Catolica," 10.xi.1955, *Santos 119a* (LISC); "Huilla" without precise locality, *Welwitsch 4266* (LISU).

The distribution of *C. huillensis* as presently known appears to be restricted to the Planalto da Humpata at altitudes of 5,000 ft. or more and is associated with the Cunene River system, while the closely related *C. gossweileri* appears to enjoy a more widespread distribution associated with the Cubango-Cuando-Zambesi systems at somewhat lower altitudes.

8. Caralluma gossweileri S. Moore in J. Bot. Lond. **50:** 367 (1912).——Rendle, Gossweiler's Angol. Pl.: 100 (1934).——White & Sloane, Stap. **1:** 346 (1937). ——Gossweiler & Mendonça, Carta Fitogeogr. Angol.: 162 (1939).——Leach in Jl S. Afr. Bot. **31:** 245 (1965).

Type: Angola, Vila Artur de Paiva, *Gossweiler 2098* (BM; COI!; K!).

All gatherings of *C. gossweileri* known to the author are quite devoid of cilia, a character which in live, and usually also in dried, flowering material, enables it at once to be distinguished from its relatives. The inner lobes of the corona appear, in the material seen, to be more or less terete above whereas those of both *C. valida* and *C. huillensis* tend to be somewhat flattened and strap-like. However the total number of gatherings of these three species is small in relation to their distribution so that it is, at present, scarcely possible reliably to assess the full taxonomic significance of these and other characters; on present evidence however, it does seem that *C. valida* is specifically distinct, whatever may be the final decision in respect of *C. huillensis* and *C. gossweileri.*

ANGOLA. Huila Distr., Forte Princeza Amelia, Cubango Riv., *Gossweiler 2098* (COI; K).

Note: Forte Princeza Amelia was a fortress near the present village of Vila Artur de Paiva (Vila de Ponte) on the left bank of the Cubango River [according to Conspectus Florae Angolensis this lies in the Bié District but a recent (1966) map places it in Huila District].

ZAMBIA. S: Livingstone Distr., Machili, 4.xii.1960, *Fanshawe 5942* (SRGH); Kalumbu, cult. Ngoma, 14.x.1965, *Mitchell 3012* (NDO), idem, cult. SRGH, i.1967, (K; SRGH), idem, cult. Nelspruit (BM; LISC; PRE).

RHODESIA. W. Nyamandhlovu Distr., Pasture Research Station, cult. *Plowes 1884* (K; PRE; SRGH).

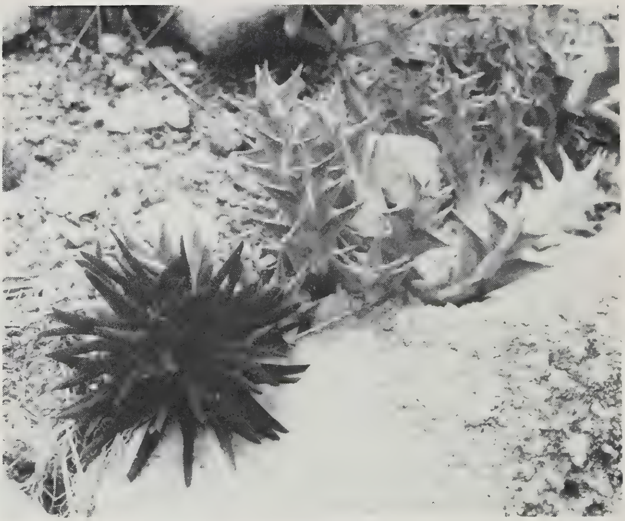


FIG. 14. *Caralluma gossweileri* S. Moore.
Mitchell 3012 Plant from Kalumbu, Kafue National Park, Zambia, flowering at Nelspruit. Flowers blackish crimson, completely devoid of ciliation.

There is, unfortunately, not a great deal of cytological evidence available; all chromosome counts which have been made on members of the group indicate $2n = 22$, as follows:

Caralluma lutea subsp. *lutea*.

Yellow flowered, Baralong, S.E. Botswana, *Smithers* s.n. cult. SRGH 3719 (K; SRGH) (Reese, personal comm.) $2n = 22$

Yellow flowered, Pietersburg, Transvaal, *Bey 47* (SRGH) (Kelly, provisional count) $2n = 22$

Dark flowered, origin unknown, (Reese ü. Kressel in Port. Act. Biol. Ser. A, 10: 48 (1967)). $2n = 22$

C. lutea subsp. *vaga*.

Dark maroon flowered, Cahama, S. Angola, *Leach* & *Cannell 14039* (K; KIEL; SRGH, etc.) (Reese, personal comm.) $2n = 22$

C. melanantha, Pietersburg, Transvaal, *Bey 45* (SRGH) (Kelly, provisional count) $2n = 22$

C. gossweileri, Kalumbu, Livingstone Distr., Zambia *Mitchell 3012* (NDO) (Reese, personal comm.). $2n = 22$

However, if, as seems likely, judging by the other published records, there exists a pattern of polyploidy within the species, such as has been found in *Huernia hislopii* Turrill, where diploids, triploids and tetraploids all occur within the typical subspecies (Reese 33 and 44 and Kelly 22), without, apparently, any significant morphological correlation, then it would seem to be unlikely that much assistance would be found in this direction.

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